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Subject : [redacted] Task Order No. 16(100,733)66 R 25X1

Gentlemen:

In order to generate a clearer understanding of the relationships between the major contractors working on significant aspects of the overall NPIC Development Program, you are invited to attend a technical conference at the NPIC on 15 and 16 November in compliance with the Associate Contractor and Panel Discussion clauses in your contract.

To give an advance understanding of the topics of discussion a brief work statement for each of the contracts is attached. Please review them at your earliest convenience, and be prepared to discuss problems of mutual interest or potential conflict. It is requested that you give a presentation in accordance with the attached agenda. It is suggested that your presentation include:

(1) One year goals
(2) Detailed description of major tasks
(3) Accomplishments to date
    (a) Theoretical assumptions reached
    (b) Emperical effort

You will not be expected to discuss anything of a proprietary nature that has not been developed under your contract with us.

Please bring any areas of concern or interest to the attention of your technical representative prior to the meeting, and if appropriate, the agenda will be modified to take them into consideration. As you will note, the afternoon of 16 November has been set aside for appropriate panel discussions. To assist us in preparing a final agenda, it would be

Subject: [redacted] Task Order 16(100,733)66 R 25X1

appreciated if you could forward an outline of your presentation to reach us no later than 4 November 1966. For information on available briefing facilities please feel free to contact your technical representative.

In order to keep the attendance to an efficient level, each contractor should restrict his representation to a maximum of 4 technical personnel with the necessary NPIC clearances. The names of those attending (and their alternates) should be forwarded to your technical representative at least one week in advance so that the necessary arrangements can be made.

To aid you in your future planning, it is anticipated that the next general panel discussion will be held in mid-February 1967.

Very truly yours,

[redacted] 25X1
Contracting Officer

By_____
Duly Authorized Representative

Attachments: (7)
Att. 1 - Tentative Agenda
Att. 2-7 - Work Statements

Distribution:
Original and 1 - Addressee
3 - P&DS/DB

NPIC/P&DS/[redacted] (20 October 1966) 25X1

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Attachment 1

TENTATIVE AGENDA

NPIC Technical Development Symposium

15 November 1966

0800-0830	Check-in/Registration	
0830-0900	Introductions and Program Objectives	
0900-1000	Information Handling, Phase I Report	25X1
1000-1015	Coffee Break	
1015-1045	Information Handling, Phase II Objectives	25X1
1045-1100	Discussion period	
1130-1230	Lunch	
1230-1400	Unconventional Imagery	25X1
1400-1415	Discussion Period	
1415-1430	Coffee Break	
1430-1600	Image Analysis	25X1
1600-1630	Questions and Answers Period	

16 November 1966

0800-0900	Automatic Stereo Scanning	25X1
0900-0915	Discussion Period	
0915-0930	Coffee Break	
0930-1030	Automatic Target Recognition	25X1
1030-1045	Discussion Period	
1045-1200	Human Factors	25X1
1200-1300	Lunch	
1300-1400	Discussion Period	
1400-1630	Individual Discussions	

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Attachment # 2

HUMAN FACTORS PROGRAM

The Human Factors Program is a long-range effort designed to increase human productivity in the exploitation process at NPIC. The program will attempt to alleviate any known psychophysical deficiencies and, through human factors research, to make the exploitation process more efficient from the interpreters' standpoint. This long-range program will probably include research in a number of broad categories. These include: (1) development of objective measures of P.I. performance; (2) measurement of the influence of image variables as they affect P.I. performance; (3) development of ambient and display lighting criteria; (4) establishedment of criteria for the selection and training of interpreters; (5) research in vision and perception; (6) research in P.I. equipment design; (7) research in the human interface with automated P.I. systems; (8) motivational research; (9) a study of P.I. performance as a function of his physiological condition.

An initial contract has been issued to the [redacted] for a nine-month effort. This project includes the following 12 tasks: 25X1 25X1

TASK # 1 - Detailed Design Definition Phase. The contractor, working closely with NPIC's technical monitors, shall further define and refine the Human Factors Program objectives as stated herein and in the composite [redacted] proposal to assure that the resultant study will best meet NPIC's present and anticipated requirements. 25X1

TASK # 2 - State-of-the-art Review. This task will include a literature search and an analysis of relevant research.

TASK # 3 - Lighting Characteristics Investigation. This task will include an examination of image interpreter performance in detection, identification, and mensuration assignments as a function of color and intensity variables in ambient luminance and display illuminance.

TASK # 4 - Visual Accommodation. This task will consist of an investigation into the feasibility of a continuous reading instrument for measuring visual accommodation without interfering with the interpreter's function.

TASK # 5 - Quantitative Determination of Image Quality. This task shall consist of manipulating the image variables of MTF, grain noise, contrast, and resolution to derive a summary measure of image quality for interpretability.

TASK # 6 - Teaming and Scheduling. This task will involve the evaluation of image interpreter performance as a function of:

a. individual work pacing

b. teaming

c. team composition

In addition to performing the above six initial tasks, the contractor will perform the following tasks (These tasks require a more intimate knowledge of NPIC operations and can only be initiated after the appropriate clearances and briefings have been administered.):

TASK # 7 - Review of NPIC Operations. The contractor is to review in depth and submit documentation of understanding of NPIC's operational imagery exploitation procedures, objectives, materials, and requirements. A limited number of key contractor personnel assigned to this program will be granted appropriate security clearances which will permit them to acquire this knowledge.

Tasks 8 through 12 will not be authorized by the contracting officer until Task 7 has been satisfactorily completed and approved.

TASK # 8 - Assessment of Value of Past and Current Research. The contractor will assess the value to NPIC of appropriate past and current human factors research. These assessments and evaluations will be directly related to NPIC's exploitation procedures, materials, objectives, and requirements.

TASK # 9 - Interpreter Performance Project Definition. The contractor shall: (a) review the factors and variables demonstrated or expected to be prime determinates of NPIC image interpreter performance and establish a priority listing of the critical experimental variables, (b) delineate and recommend a research program designed to provide the quantitative performance data which will define and describe the relationship between these variables and NPIC interpreter performance.

TASK 10 - Stereoscopic Viewing Project Definition. The contractor shall: (a) examine the factors and variables which might affect NPIC interpreter performance as a function of stereoscopic vs monoscopic viewing; and (b) define a systematic program designed to qualify the comparative performance of NPIC interpreters utilizing stereoscopic and monoscopic viewing as a function of these major factors.

TASK # 11 - Associated Contracts Review. The contractor shall serve as associate contractor and human factors consultant on other major R&D programs of the NPIC as required by the technical representative of the contracting officer. This task shall consist of: (a) examination

of each of NPIC's other major R&D programs to determine physiological and psychophysical problems which may accrue as a result of those various programs; (b) making recommendations on, and definitions of, human factors research projects aimed at alleviating the potential problems of each of these programs.

TASK # 12 - The Preparation of an Initial Recommendation Report and Briefing. Seven months from start of contract, [redacted] shall make specific written recommendations in draft form and provide oral briefings regarding a five-year program. The recommendations for subsequent work shall include individual project justification, description, schedules, major milestones, expected results, estimated costs, and possible alternatives. These recommendations in no way obligate the Government to contract for these efforts. A contract review will be made by the Government upon the completion of this task. 25X1

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Attachment # 3

AUTOMATIC STEREO SCANNING PROGRAM

The Automatic Stereo Scanning Program is a long-range effort initiated to provide the image interpreter with the advantages of stereoscopic viewing during first phase photo exploitation, in which all the film from a reconnaissance mission is rapidly scanned to detect new high priority intelligence. Because the technique of stereoscopic viewing now requires exact, tedious manual alignment of two images, it is necessarily reserved for detailed analysis of selected targets, while first phase exploitation is based on monoscopic viewing.

The principal problem underlying the stereo scanning dilemma can be found in the designs of the acquisition systems which seek to optimize both resolution and area coverage. Such designs are panoramic, strip, and multi-station photographic systems which produce conjugate stereo imagery which assumes odd angular positions and widely varying stereoscopic intervals. To achieve comfortable and continuous stereoscopic fusing of such photography necessitates: (1) automatic correlation of conjugate images, (2) automatic removal of inherent image distortions, (3) presentation of a stereo model -- in stationary and slowly traveling (scanning) mode -- to the operator, (4) achieving the stereo presentation without significant degradation of image content and without significant increase in total processing time, and (5) handling the diverse outputs of existing and future acquisition systems in a manner compatible with the requirements of the operational imagery analysis components of NPIC.

An initial contract has been issued to the [redacted] 25X1
[redacted] for a twenty-two-month effort, divided, 25X1
essentially, into two phases:

PHASE I. At six months after initiation of the contract, [redacted] shall 25X1
submit for evaluation and approval a detailed design plan and functional mock-up of an operational prototype Automated Stereo Scanner, including a revised cost proposal for the fabrication phase and containing a detailed written technical status report.

PHASE II. Upon approval of Phase I, the [redacted] will under- 25X1
take a sixteen-month equipment development program for the fabrication of the prototype instrument. In addition to fabrication, installation, and checkout of the operational prototype Automated Stereo Scanner, [redacted] shall compile an approved final performance test plan, an 25X1
operation and maintenance manual, recommended spare parts list, reproducible engineering drawings, monthly progress reports, a six-month (of Phase II) interim report with cost breakdown and planned course of action, and a final report after final acceptance of the prototype.

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Consideration will be given during the initial development for follow-on contracts for [redacted] (especially in the area of stereo projection viewing), detailed operational test of the prototype scanner, and fabrication of subsequent production-model Automated Stereo Scanners. 25X1

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Attachment # 5

INFORMATION HANDLING PROGRAM

The Information Handling Program is currently directed toward the development of an integrated information system within NPIC which will permit greater utilization of Automatic Data Processing equipment in exploiting the current and predicted increases in the volume of photographic imagery.

The total program is divided into the following four major phases which are being placed under contract sequentially. Phase I, Analysis and Projection of System Requirements, has been completed by the [redacted] A proposal for Phase II, System Design, has been submitted by [redacted] and is currently under consideration. 25X1 25X1

PHASE I. Analysis and Projection of System Requirements:

During this phase substantive information handled by NPIC was reviewed, processing methods and file structures were analysed, flow charts and statistical analyses were prepared of current and projected operations, alternative concepts were developed, and a conceptual design and implementation plan was generated.

PHASE II. System Design:

In this phase alternate methods for performing the system functions, based on the conceptual design resulting from Phase I, will be developed and evaluated. The detailed system configuration and overall operation will be established, detailed specifications for system components will be prepared, and a detailed implementation plan is to be devised.

PHASE III. System Engineering Procurement and Programming:

This phase will encompass the acquisition and test of the system components, both hardware and software, necessary to implement the Phase II design.

PHASE IV. System Installation and Test:

In this final portion of the program, system components will be installed, checked out and tested as a system, personnel will be trained, and all final operation, maintenance and computer documentation will be prepared.

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Attachment # 6

IMAGE ANALYSIS PROGRAM

The Image Analysis Program is designed to provide a better understanding of the fundamental problems of image recording and read-out, and to reformulate image theory in terms of the partial coherence of illumination so that a sound basis may be established for the implementation of the next generation of viewing and reproduction equipment. In addition to this preparation for the future, a thorough analysis is to be made of current problems and weaknesses. Modifications, changes, or reassessment of presently-used equipment and techniques will be made accordingly. The research effort will include such considerations as illumination, optical systems, camera systems (by inference), photographic processes and materials, viewing and evaluating, and the objective interfaces of aerial photography with the interpretive process. The program is a long-range effort, nominally planned for approximately five years.

An initial contract has been issued to [redacted] 25X1
for a one year's effort, with subcontractors of [redacted] and [redacted] 25X1
The first year's program will be directed toward three main areas: (1) definition of NPIC image analysis problems; (2) theoretical studies of optical, photo-processing, and photometric problems; (3) formulation of lines of investigation for the following four years. The program includes the following 11 tasks:

TASK # 1A - Detailed Definition of Jobs to be Done. After the contractor has become thoroughly familiar with NPIC's image analysis requirements, procedures, and problems he must define in detail the specific tasks to be performed during the life of the task order both by [redacted] research personnel and by subcontractors. [redacted] will provide justifications, work statements, procedures, and a description of the products of each job to be performed, and will submit these to the Government for approval. A contract review will be held at this time, at approximately two months after initiation. After written approval by the Contracting Officer, [redacted] will be responsible for the implementation, conduct, and satisfactory completion of these various jobs, including the selection and work of the subcontractors. 25X1 25X1 25X1

TASK # 1B - Program Review. A review in depth and a documentation reciting the contractor's understanding of NPIC's technical and operational image analysis procedures and requirements. Key contractor personnel shall, through the medium of extended briefing sessions at NPIC and through use of results of other studies conducted in NPIC, become intimately familiar with the nature of the imagery currently being supplied to NPIC as well as anticipated future imagery

from systems now under development. They will be required to become knowledgeable about the Center's current and future exploitation methods, problems, and requirements in the image analysis field. The contractor's technical representatives must also become familiar with the photo reconnaissance imagery currently exploited by NPIC in order that they may gain the background knowledge needed to attack the Center's imagery exploitation problems.

TASK # 2 - Theoretical and experimental studies will be carried out in the areas of optics, photographics, and photometrics. The Program will involve the solution of problems of increasing complexity to provide guidance for a meaningful theoretical and experimental interaction. The approach to the optical studies will be based on the formulation of imagery in the context of partial coherence, and will include quasi-monochromatic problems as well as the extension to polychromatic conditions. Amplitude, phase, and their combination will be treated. The experimental program shall follow the same pattern or sequence as the theoretical program.

TASK # 3 - [redacted] will work on the imaging properties of grainy films. This will be done in conjunction with experimental investigations at [redacted] They will start by using experimental films supplied by [redacted] They will work from here, both theoretically as well as experimentally, towards the case of films with thicker emulsions and more complicated grain size distributions. 25X1 25X1 25X1

TASK # 4 - [redacted] shall investigate the effective exposure concept. They will construct a series of sine-wave targets on a family of commercially available films of interest to NPIC, using the best possible sensitometric control. The targets will be traced by the microdensitometer and by means of existing [redacted] computer programs. The traces will be filtered to remove noise, passed through the H and D curve, and Fourier-analyzed to determine the harmonic content remaining after the density is reduced to effective exposure. 25X1 25X1

TASK # 5 -

Theory:

1. Study the theory of the characteristic curve as a function of spatial frequency and as a function of photon noise and photon scatter, especially for high spatial-frequency images.

2. Study the theory of developed photographic density with respect to:

a. The opacity of developed silver, especially as a function of layer thickness at high frequency.

b. Density at low contrast for high-frequency information.

c. The Density-log E relationship at high frequency.

3. Make a preliminary investigation of the optics of the silver photographic images when used as an image source for the preparation of duplicate and multiple generation copies.

Experiment:

1. Analyze in detail commercial emulsions that are of immediate interest to NPIC for calibration purposes.

2. Prepare model emulsions in support of the Theory Program.

3. Set up an electron microscope program that will allow the study of developed filamentary silver, of grain size distributions, and of silver halide crystal structure by the transmission microscopy method, or by the replication method if necessary. Supply support data as dictated by the theoretical study.

TASK # 6 -

1. Re-examine the significance of microdensitometric tracing at high line frequency, establishing:

a. The coherence of actual scanning beams; determine where phase effects become significant.

b. Edge trace procedures (including statistical approaches) and the variation of the output with the aperture of the condenser and objective optics; standardization of optics and the wavelength band of measurement.

TASK # 7 - Under this task order [redacted] will supply the necessary personnel, services, and facilities to: 25X1

1. Investigate the parameters involved in the lens design of optics for spatial filtering systems (image manipulation).

2. Perform work on the imaging properties of grainy films. This will be done in conjunction with experimental investigations at [redacted] 25X1

3. Investigate the combined optical properties of viewing equipment and the photointerpreter.

4. Compute the "transfer" function of an aberrated lens in conjunction with the coherence of the illumination of the object.

5. Study the effect of temperature changes on the image quality of lenses of various construction.

6. Perform experiments in conjunction with [redacted] on the amount of phase change that can be introduced in various glasses by ion migration. 25X1 25X1

TASK # 8 - [redacted] will participate in both the theoretical and experimental portion of the Image Analysis Program. In particular [redacted] will study the following: 25X1 25X1

1. The effective exposure concept.

2. The variation of photographic image with depth within the emulsion.

3. Image depth.

4. Edge Trace Analysis.

5. Problem-Oriented-Studies.

This phase of the program will be defined after a series of consultations with the staff at NPIC and detailed in the report for Task # 1A.

TASK # 9 - While the Image Analysis Program is envisioned as a continuing, long-term program the contractor shall deliver a semi-annual report to the Government summarizing the findings of this study.

TASK # 10 - The preparation of an initial recommendation report and briefing. Six (6) months from the start of the program, [redacted] shall make specific written recommendations regarding the five-year program. In the recommendations for subsequent work; major milestones, descriptions of future investigations, estimates of cost, and schedules for completion of each exploitation technique will be included. 25X1 25X1

TASK # 11 - At the end of seven (7) months, [redacted] will submit a firm proposal and cost estimate for the following year program and an estimated schedule and costs for the remainder of a five-year program. This is no way obligates the Government to contract such a program. 25X1

Attachment # 7

AUTOMATIC TARGET RECOGNITION PROGRAM

The Automatic Target Recognition Program is a major long-range effort to develop automatic and semi-automatic aids that will increase the speed and accuracy of the photointerpreter. The present program is scheduled to run for five years and will be concerned with specific objectives such as:

1. Screening large volumes of imagery to separate "sterile" portions of the film from those containing possible targets of interest to the imagery analysts;

2. Classifying targets into broad categories;

3. Re-scanning large volumes of previous coverage to search for one type of target of known configuration;

4. Detecting changes in multiple coverage of targets;

5. Providing automatic recognition and correlation of map area to image area in scanning operations;

6. Providing automatic inventory of similar objects within an image field.

A contract has been signed with the [redacted] for a nine month effort. The initial contract includes the following eight tasks: 25X1 25X1

TASK # 1 - Detailed Design Definition Phase. The contractor, working closely with the NPIC technical monitor, shall further define and refine the Automatic Target Recognition Program objectives, Tasks 2, 3, 4, and 5 listed below, in order to assure that the resultant Program will best meet NPIC's present and anticipated requirements. This definition phase will result in a document recording mutually agreeable goals and methodologies for the Program.

TASK # 2 - Analytical Evaluation of Available Techniques. This task shall consist of a thorough literature search and consultation with technical personnel of other industrial concerns, research institutes, and universities to provide a data base for the evaluation of existing automatic target recognition techniques.

TASK # 3 - Analytical and Empirical Studies on Optical Filters. This task shall consist of exploration of optical extraction techniques for the automatic target recognition input sub-system.

TASK # 4 - Selection, Analysis, and Processing of Imagery. This task shall consist of selection, analysis, and processing of representative imagery which will be supplied by [redacted] and by suitable government agencies. 25X1

TASK # 5 - Systems Effectiveness and Evaluation Study. This task shall consist of providing objective evaluation of experimental test results and comparison of various sub-systems and techniques.

TASK # 6 - Contractor's Understanding of NPIC Operations. This task shall consist of a review in depth and result in documentation reciting the contractor's understanding of NPIC operations relating to technical and operational imagery exploitation procedures and requirements. A limited number of key contractor personnel assigned to this program shall, through the medium of extended briefing sessions at NPIC and the results of other studies conducted in NPIC, become intimately familiar with the photo interpretation exploitation of all types of imagery currently being used, as well as imagery from systems now under development. They will be required to become knowledgeable about the Center's current and future photo interpretation exploitation methods. The principal contractor will be given all possible aid in familiarizing himself with the Center's requiremtns, objectives, materials, and methods of operation and with other NPIC sponsored R&D programs which may affect the Automatic Target Recognition Program.

TASK # 7 - Subsystem Design Specification and Feasibility Test. This task shall consist of evaluation of technique feasibility and development of a set of performance requirements to be met by subsystems under test as elements of an ATR system.

TASK # 8 - Initial Recommendation Report and Briefing. Six months from start of contract, [redacted] shall make specific written recommendations in draft form and provide oral briefings regarding a five-year program. The recommendations for subsequent work shall include individual project justification, description, schedules, major milestones, expected results, estimated costs, and alternatives. These recommendations in no way obligate the Government to contract for such a program. In addition, six months from start of contract [redacted] shall prepare a Definitive Program Recommendation which shall include schedules and cost estimates for a twelve-month follow-on effort. A contract review will be made by the Government upon completion of this task. 25X1 25X1